



Lightning and Surge Protection for BNC Monitoring and Diagnostic Equipment

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Lightning-caused electrical surge poses significant problems to electronic equipment in most parts of the world. While modern electronics are employing increasingly smaller, faster, and lower-power components, these characteristics also make it increasingly difficult for the components to dissipate any significant induced energy. Therefore, their susceptibility to over-voltages and surge currents is increased. In critical systems (such as machinery protection systems used for shutdown protection), these conditions can cause problems not only for the protection equipment itself, but also for the machines they protect. This article describes current best practices for protecting Bently Nevada equipment from damage caused by lightning-induced surges. ***Lightning and surge protection needs to be considered for all installations.***

Grounding

Proper grounding is critical for a lightning-resistant system. To prevent ground loops and potentially destructive voltage differences, *a properly grounded system should be grounded at only one point.* On an intrinsically safe system, that single point ground is located at the safety barrier. If you order cabinets from Bently Nevada, they are supplied with separate ground busses for equipment ground and safety ground. If the installation site has both grounds available, the grounding bar in the cabinet between equipment ground and chassis should be removed. Note that the surge suppressors (see below) should always be tied to safety ground and not to instrument ground.

Surge Suppressors

Surge suppressors are necessary to protect the inputs and outputs of instrumentation from overvoltage conditions caused by lightning-induced currents. Surge suppressors work by clamping the voltages at the inputs/outputs to manageable levels and shunting the excess current to ground. It is important to note that all of the inputs and outputs on Bently Nevada instruments must be protected, including the following:

- AC power – The ac lines are best protected using an uninterruptable power supply (UPS) unit with built-in surge suppression. This not only provides protection from surge currents, but also provides protection from short duration power losses and brownouts. Bently Nevada can supply the UPS unit, or we can provide engineering assistance regarding properly sizing a UPS of your choice. The UPS units must be appropriately sized to handle both the nominal and peak current loads of the systems they are protecting.
- Monitor inputs – While 3500 monitors have a significant level of “built-in” surge protection, additional external surge suppressors are recommended for optimal lightning protection. This can best be accomplished by using hybrid devices that employ a combination of both gas discharge tube and avalanche diode technology. Bently Nevada has tested various devices to ensure they are suitable in both hazardous and non-hazardous areas. Contact us for specific part numbers to be used with each monitor type and transducer input type.
- Communication lines – RS422/485 and RS232 serial

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inputs/outputs must also be protected from surge conditions. Contact Bently Nevada for appropriate part numbers for 9-, 15-, and 25-pin configurations.

- Network lines – Fiber optic cable is the recommended medium for use with networks used on critical data systems such as 3500 and TDXnet™. Fiber optic cable provides inherent galvanic isolation to surge currents and no additional protection is necessary. Bently Nevada can supply appropriate fiber optic cable in 10-foot increments up to 500 feet and 100-foot increments to 6500 feet.

Process Considerations

In many critical applications, the loss of a process due to a lightning strike can have much larger financial implications than the loss of the monitoring equipment. Therefore, a major concern in applications using Bently Nevada instrumentation for machinery protection is avoiding machine trips caused by lightning surge currents. While the recommendations provided thus far in the article are intended to protect the monitoring equipment from permanent damage, they will not necessarily prevent false machine trips. Because the clamping voltages for the surge suppressors are necessarily outside of the normal operating ranges of the transducers, a surge condition can still cause a transient “NOT OK” condition even though the protection equipment is not damaged. This is normally not a problem for radial vibration monitors because of the “timed OK channel defeat” feature. Thrust monitors, on the other hand, interpret a “NOT OK” condition as an alarm. Although we do not recommend it, some customers configure their systems to trip on “NOT OK.” This can be a problem. (Editor’s Note: Please refer to “Voting Thrust Measurements with Other Parameters,” *ORBIT*, Vol. 22 No. 1, First Quarter 2001, pp. 51-54, for more information on dual-voting thrust monitors.) Testing has shown that setting the alarm time delays to 1 second or more greatly decreases the chances of a transient surge current causing a false alarm. The user will need to weigh the tradeoffs of delaying protection alarms for the machine against the decreased chance for lightning surges to cause false trips.

Cabinets

Virtually all Bently Nevada monitoring and online diagnostic systems are assembled into consoles or cabinets of some kind, either by Bently Nevada, the customer, or one of the customer’s suppliers. Proper cabinet design is a significant part of protecting your



Typical surge suppressors installed in a Bently Nevada cabinet.

instrumentation from lightning and surges. Cabinets provide not only physical protection for the enclosed equipment; they also provide some degree of electrical protection when properly designed and built. When manufacturing cabinets, proper design is essential in providing systems that are less susceptible to lightning-induced currents and surges. This requires appropriate attention be given to component layout, internal grounding, wiring and component spacing, signal isolation, barriers and surge suppressors, and wire routing, to name a few.

One way to ensure these myriad details are properly addressed is to let Bently Nevada supply your cabinets. Our cabinet design engineers and assemblers have years of experience dealing with all aspects of cabinets, including comprehensive documentation and labeling for ease of maintenance. Entrusting the total scope of your system to Bently Nevada, including cabinets and proper lightning and surge protection, ensures you will get the most value from your investment in our machinery protection and management instrumentation.

Summary

In most parts of the world, lightning is a concern for at least part of the year. Electrical surges, independent of lightning, can be a problem as well. With proper care, your exposure to damage from such events can be minimized. The considerations outlined in this article represent only a fraction of the expertise we have gained over the years in designing and installing instrumentation systems resistant to lightning and surge-related damage. ***It is important to consider these issues during system design.*** For more information on this important topic, contact your nearest Bently Nevada sales or service professional. [🔗](#)